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REVIEW ARTICLE

Language by ear and by eye

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J. P. KAVANAGH & I. G. MATTINGLY (eds), *Language by ear and by eye*. Cambridge, Mass.: M.I.T., 1972. Pp. xiv + 398.

Sponsored by the Growth and Development Branch of the National Institute of Child Health and Human Development, a research conference on the relationships between speech and learning to read was held at Belmont, Maryland, 16–19 May 1971. The task set up by the conference was to shed some light on the processes involved in listening, speaking and reading, and – ultimately – to bring us nearer an answer to the following question: why is it that reading needs to be taught, often at enormous costs of time and energy, while speech perception comes easily and without tuition?

The proceedings of the conference have been published in the volume reviewed here. The book clearly shows the controversial nature of the subject chosen – the solutions proposed to several intricate problems are as numerous as the participants involved in the discussions. The lack of consistency no doubt owes much to the fact that the contributions range from concrete reports of experiments in reading, given by practising research workers in this field, to theoretical papers of a very high level of abstraction. One also has a feeling that terminological uncertainty is a source of confusion in the debates. This is especially true of the discussions on the way in which different orthographies represent different linguistic levels, and on the linguistic codes used by the reader.

Difficult and contradictory as its subject-matter may be, the volume nevertheless is inspiring reading, containing fruitful ideas and an impressive amount of knowledge brought together by highly learned specialists in the fields of psychology and linguistics. Also useful are the bibliographies following each paper.

ACQUISITION OF SPEECH AND READING

A perpetually recurring topic during the conference was why reading seems to be more difficult, less easily acquired, than speech. Among the many explanations offered, the one that listening is more 'natural' than reading (Mattingly 134) deserves some special attention. The notion of 'naturalness' here seems to be based on the fact that, when reading, we all seem to use some sort of speech-based code rather than a visual one: most of us articulate – openly or in a suppressed way – or use some kind of speech imagery to understand printed words and sentences; we make a phonological transformation of the written message (Conrad 206 f.). To put it very roughly: if we do not make a phonological transformation of what we read, it does not make sense to us. (A consequence of this is that what we mean by stylistically bad writing is often a text that is difficult to speak or listen to (Mattingly 143). It is also well known that the auditory after-image is superior to the visual one (Crowder 153).) Conrad's studies of deaf subjects, however, show that reading is possible without a trace of phonology, and thus he concludes that for hearing people phonological coding is a preference, not a necessity (cf. Brewer 362 f., La Berge 242 f.). Why then should there be this preference for the speech-based code?

In accordance with Chomsky's innateness approach to language acquisition, Ignatius C. Mattingly explains it this way: 'There is good reason to believe that special neural machinery is intricately linked to the vocal tract and the ear, the output and input devices used by all normal human beings for linguistic communication' (133). Conrad attempts another explanation – which however he immediately discards as being 'oversimple': 'Our initial experience of language is aural; words come to us as sounds, and we may for ever after need to hark back to auditory referents. Just the same, many of the new words that we learn, we initially read; yet when we meet them again we recode them phonologically along with all the others. Perhaps more likely, our initial reading experience is of vocal reading. Parents and teachers want to hear what we see' (217). The reason why Conrad – and other contributors to the volume – are reluctant to acknowledge this explanation may be that in 1971 there was no scientific framework to fit this explanation into, in order to make it more decent and dignified. The dominance of the theory of innateness made us almost forget that there are such things as environmental factors.

But now that research workers in child language have spent some years trying to test the innateness hypothesis and to apply the purely grammatical-syntactic approach to a rich corpus of tape-recorded texts, they very keenly feel the need for a totally new approach. In this new approach emphasis is laid on the meaning of utterances (e.g. Bloom 1970). The focusing on meaning has made it necessary to take into account such factors as the child's non-linguistic behaviour (gestures, facial expression, etc.), the speech and the non-linguistic behaviour of persons communicating with the child – which may serve as helpful tools to the child to communicate his intentions – and the things and events around the child at the moment of speech, which may serve as points of reference, making explicit linguistic communication unnecessary. (This approach is taken for example by the Berkeley Cross-linguistic Language Development Project, headed by D. I. Slobin, and the Bristol project on Language Development in Pre-school Children, headed by G. Wells.) The tendency has been away from the narrow linguistic approach and towards viewing the child's linguistic activities as part of a total scheme, where the child's general cognitive development and his general experience of the world and people around him play a great part.

This new trend certainly owes much to the influence from European – particularly East European – research (see Průcha 1974), which is indebted to the thinking of psychologists like Piaget and Vygotsky in the same way as American research has benefited from the ideas of Chomsky. The new trend has been brought about by international congresses like that in Brno 1970, under the auspices of K. Ohnesorg, and by researchers like Slobin with his untiring work for global co-operation within the field of child language research. Accordingly, attempts to explain the mechanisms of language acquisition are now again beginning to bring 'environmental factors' to the fore (Wells & Ferrier 1972, Ingram 1972). My own experience, based on field work in early language acquisition and in early reading, also suggests such an approach, which may be briefly sketched as follows. The child learns his language in close co-operation with people around him: through listening to speech that refers directly to things and events around him and to his own and other people's actions, he learns to attach language to reality, first learning words with a simple, concrete reference, then gradually absorbing also linguistic material with a more abstract or relational function (here the information often comes from the language context itself). Thus the child builds up first a passive and then, parallel to this, also an active language, through listening, looking and acting. In this process of language acquisition DIALOGUE plays a great part. Through dialogue the child is initiated into language in function, language as a means of communication between human beings: he gives and receives commands, requests, questions and answers, he is told things and tells things, and so on (Söderbergh 1974).

Now, to return to Conrad's 'oversimple' explanation of why we prefer a speech-based code when reading, we find that this explanation fits very well into the framework of a theory of language acquisition along the lines sketched above. Our 'initial experience of language is aural' indeed – or rather multimodal: aural, visual, kinaesthetic, etc. – the ears taking in a perpetual stream of language, the eyes and the other sensory organs simultaneously taking in other information, while the brain somehow finds out the correspondences between the information coming through the ears and the information coming through the other senses. We understand what is said. From this early experience our cognitive 'grasp' of the world is inseparably tied up with speech: speech evokes meaning. Then between five and seven years of age (depending on the sociocultural pattern of the country where the child is brought up), a new kind of language is introduced: the written language. But this language is in certain respects regarded as secondary (Mattingly 133), as based on the spoken language, and it is taught with a constant reference to the spoken language: the written word is said to stand for its spoken counterpart (see Söderbergh 1971: ch. 1 for a discussion of the controversial question of the written language as secondary). During the process of learning the techniques of reading, the pupil must constantly check his result against his experience of spoken language; it is through this spoken counterpart that he arrives at the meaning of what he reads. Written language evokes spoken language which evokes meaning. It is quite easy to see that under these conditions an enormous amount of reading experience will be necessary to make it possible to 'skip' the intermediate stage of speech association and to relate the written word immediately to meaning.

THE DEAF CHILD'S LANGUAGE ACQUISITION

When it comes to children born deaf, the problem is obvious. The deaf child certainly has an experience of the world around him – a visual and kinaesthetic experience – but he never learns to attach language to this experience in the way a hearing child does. The little he learns of language is learnt with a great deal of work and patience, and it is done without aural means, through lip-reading, gestures, etc. Now when it comes to reading, the reading instruction afforded deaf children does not substantially differ from that given to hearing children. Even if an unusually large number of pictures are used, the written language is taught through the medium of and with reference to a spoken language that the child does not possess. The child is in as bad a position as an Englishman who is forced to learn Russian from an elementary Russian textbook written for Hungarians – without knowing a word of Hungarian. No wonder then that most deaf people are bad readers! Conrad in his section 'Reading without speech' (223 f.) also makes a great deal of the fact that inappropriate teaching may be responsible for deaf children's reading-backwardness as much as deafness itself. What is needed then is to relate the written language directly to the child's experience of the world around him, to give him the written language as an accompaniment to the things and events around him and to his and other people's actions, exactly as the hearing child gets a stream of speech accompanying his daily experiences. Now writing is unusually ill-suited to be a natural accompaniment in everyday situations because both hands are occupied in writing, one with pen and the other with paper. Moreover, when written language is used as a medium, the child itself cannot take an ACTIVE part in the speech situation as easily and as early as when spoken language is used: the ability to write manually cannot be developed well enough before the age of 3;6 to 4;0 for motor reasons. Nor will the basal function of language as a means of communication, as DIALOGUE, stand out very clearly to the child if he is exposed only to written language in its conventional form. Another rather ingenious method, however, is to use finger-spelling. Wolff (1973: 200) cites a passage from the memories of Howard Hofsteater (1959), a man who was profoundly deaf from the age of 8 or 9 months, and who was brought up with finger-spelling by his likewise totally deaf parents. His parents talked to him 'casually and constantly...on their fingers, just as hearing people do vocally to their babies' – and they used only finger-spelling between themselves when Howard was present. Howard soon began using finger-spelling himself in communication with his parents and acquired language in this way exactly as a normal hearing child acquires the spoken language. At 4;6 his parents related finger-spelled letters to written letters, and so Howard learnt to read as easily as a normal hearing child.

I have dwelt on this subject at some length because I want to attack seriously the prevalent idea that language is inevitably aural. For obvious 'natural' reasons, it is many times easier to use ears and tongue than eyes and hands in language communication. Eyes and hands are occupied with so many other necessary things, observing and handling the environment. But when the normal channels are lacking, we can manage nevertheless, and Mattingly's statement (135) that it is not possible for deaf children to acquire language through reading must be contradicted. Given that you do not present the written language only through the medium of the spoken language, but relate it directly to things, events and actions around him, the deaf child will acquire language through reading. For reasons given above, it might however be more convenient to sign the letters in the air than to use letters printed on paper until a basic language is acquired. Then conventional written language may be introduced on the base of finger-spelling. Nevertheless, the deaf-born child will be at a disadvantage compared with the hearing child in the field of reading, because, as Conrad points out, our written language is designed for hearing people: 'the majority of words begin with a minority of different consonants, usually followed by a vowel, all of which sound different but which in print, except for *i*, look quite similar' (235).

ORTHOGRAPHY AND LINGUISTIC AWARENESS

The idea of the biologically determined ties between language and the ear might seem more plausible in our Western culture, with its alphabetic writing based on sound. After reading Samuel E. Martin's most instructive contribution to the conference, dealing with non-alphabetic writing systems, and John B. Carroll's discussion of Martin's paper, one is apt to look at things less dogmatically. A most interesting observation is made by Carroll, who mentions the Chinese habit of 'writing in the air' to avoid ambiguity of speech (108).

Another important question discussed is what role orthography plays in the relative difficulty with which people learn to read. Mattingly (133 f.) regards reading as a skill, based on the reader's AWARENESS of the primary linguistic activities of speaking and listening. According to Mattingly, the relative difficulty of reading might then be explained by the fact that degree of linguistic awareness varies considerably from one person to another. Edward S. Klima (57 f.) has the idea that different orthographic systems might reflect different linguistic levels. He suggests that the success of an orthography must depend on how well it reflects the linguistic levels for which we have the strongest linguistic intuitions (i.e. awareness). He cites a statement by Chomsky & Halle (1968) that English orthography should reflect the linguistically well-motivated deep structure of English words, thus in principle being an almost optimal orthographic system. John Lotz (120 f.), however, a linguist with a firm historical background, succeeds in casting doubt on Halle's claim that English orthography should reveal the underlying morphophonemic system rather than represent surface appearances – what today might be analysed as an underlying morphophonemic system is nothing but yesterday's surface phonology, obscured by historical development.

In some way, however, we seem to be more sensitive to certain linguistic units than to others. Mattingly says that 'phonological segments are less obvious units than morphemes or syllables' (140). That is why logographic and syllabary systems are easier to learn, although – totally – they require more time, as they contain more units. Harris B. Savin has found that 'even for literate adults the syllable is a far more natural, more easily available perceptual unit than is the phoneme' (322). Franklin S. Cooper takes a similar view when he says that the ability to analyse speech into phonetic segments is an acquired skill not to be expected of the young child (43). Savin has also observed that pupils who fail to learn to read know that /windou/ (window) consists of /win/ and /dou/ (cf. also Borgström 1973), but they cannot analyse syllables into phonemes. According to Savin, the crucial problem in learning to read is one of LEARNING TO IDENTIFY PHONEMES. How this problem should best be tackled is discussed at length by Philip S. Gough (346 f.), and I shall return to it presently. First, however, I propose to refer briefly to the old question of reading maturity and age, which is also touched on in the volume under review.

READING MATURITY AND AGE: SHORT-TERM MEMORY

Savin quite frankly states that 4-year-olds cannot analyse syllables into phonemes (322), and Wayne O'Neil is of the opinion that children's phonological perceptions are more superficial than those of adults (113). Paul A. Kolers refers to Edmund Burke Huey (1908) who 'had recommended that reading instruction be delayed until age 10...to give the child time to master the phonological system of his language' (126). Mattingly, however, questions the assumption that a child does not acquire all of his phonology until a fairly advanced age, and Alvin M. Liberman thinks that it might be a question of degree of awareness on the part of the child 'rather than actual intuitive knowledge' (126). In my opinion, this awareness is brought about by means of initiating the child into the written language – as George A. Miller puts it: 'You think about words very differently after you know how to write them' (127). Contrary to what Huey thinks, this initiation could be done very early, as early as the child begins to speak. But more about that later.

The superstition about the child's disability to learn to read before a certain age has its most clear expression in Conrad's paper. Starting with the observation that the child does not learn to read until the age of 6, he sets out to find the reasons why a child cannot learn to read before this age.[1] He devotes four pages to this problem, referring to experiments that seem to have very little to do with the matter discussed. Finally he suggests that the reason might be found in the child's short-term memory (STM), which is perhaps not 'mature' enough before 6 to permit the child to keep the linguistic material he has read in his mind long enough to have it make sense. According to Conrad, the child might lack a phonological STM store before the age of 6.

There is none the less an interesting aspect about STM being responsible for the lack of success in reading – provided that we look at the young child in the same way that we look at older children and adults that are poor readers. Donald Shankweiler and Isabelle Y. Liberman state that slow reading of individual words may contribute to poor performance on paragraphs (299); if the reading is not quick enough there is a decay in primary memory (PM).[2] Or, as Philip B. Gough puts it: 'If it takes too long to read a given word, the content of the immediately preceding words will have been lost from the PM, and comprehension will be prevented' (354). Also Carroll, in his comparison of alphabetic and morphographic writing systems, stresses the role of rapid word recognition in skilled reading (106). Mattingly says that the reader 'must have an extensive vocabulary of sight words and phrases acquired through previous reading experience' (142). When this fails him 'he must be ready with strategies by means of which he can identify a word that is part of his spoken vocabulary ...or assign a phonological representation to a word altogether unknown to him'. According to Mattingly (145) the poor reader BUILDS UP HIS PHONOLOGICAL REPRESENTATION TOO SLOWLY. A minimum rate is required for linguistic synthesis. David La Berge puts it a bit differently when he says that 'word-by-word reading focuses attention on the decoding process at the expense of other necessary operations such as retention' (243).

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[1] 'Authority tells us', says Conrad (219), 'that he is not old enough to begin to read.' To me it is indisputable that the fact that children do not learn to read until the age of 5–7 is merely a result of a socio-cultural structure, with children starting school at this age.

[2] STM and PM are two different terms for the same concept. On (linguistic) memory and its function, Robert G. Crowder (251 f.) and Donald A. Norman (277 f.) have both made an illuminating contribution to the volume.

BREAKING THE CODE AND ATTAINING FLUENT READING

Returning to the question of how one may best learn to read, we thus seem to be faced with two main problems:

1. How should the reader *in spe* – of an alphabetic written language that is! – BE MADE AWARE OF THE PHONEMES in order to be able to 'break the code', to find the correspondences between sounds and written symbols, and then finally acquire the ability to decode a written message?

2. How should we prevent difficulties in this decoding, as long as the pupil is not clever or quick enough, from interfering with the higher linguistic processes that lie behind the grasping of the meaning of the sentence?

Gough's idea of cryptanalysis

The first problem is taken up at length by Gough (348 f.). To help the child to become a decoder, he says, 'we cannot show him that this character goes with that systematic phoneme, for there is no way to isolate a systematic phoneme... we cannot teach him the code'. Even when we use phonic methods, we do not teach the child the code, we just teach him 'to name a letter (or letter pair) with a syllable that contains the appropriate systematic phoneme'. 'The rules he learns are not the rules he must master, but rather heuristic for locating words through the auditory modality. The lexical representations of those words then provide data for the induction of the real character-phoneme rules' (350). Thus phonic methods, like look-and-say methods, leave it to the child to find out about the code – although with phonics we deliberately focus on the sounds of the words. According to Gough the child masters the code through a sort of cryptanalysis. He is 'provided with a set of pairs of messages known to be equivalent, one in cipher text (writing) and one in plain text (speech). They must be provided in sufficient quantity to enable him to arrive at a unique solution, and that is all' (348).

Gough then gives an account of two experiments both performed with three groups of subjects. One group was taught a series of characters (arabic characters in one experiment, an artificial alphabet in the other); the second group was taught a few words containing these characters; and the third (control) group was given an irrelevant task. In the first experiment, the subjects were asked to learn a new eight-item list in which the characters were recombined to form novel words: this was learned most rapidly by the phonics group. In the second experiment the subjects were given a 'transfer list' containing words made up of some of the characters in question: here also the phonics group performed significantly better. The reason for this, however, is obvious, as Gough says: 'the organization of the elements (letters) fell short of that which could be expected to yield a successful cryptanalysis' (352). Moreover, the whole-word group had no reason to try to detect correspondences (nobody told them to!), as the material was so small that rote-learning seemed to be the most natural way to tackle the problem. As Gough points out, it is only when there is an advantage in trying more complicated strategies that a learner takes the trouble to leave rote-learning. 'The greater the advantage afforded by induction of structure (over rote memory) the more frequent the induction' (353). Gough thinks it is the same thing with children learning to read by means of a look-and-say method: they do not begin to 'map characters on to phonemes until simpler strategies will no longer work' (349). Gough believes that the corpus needed is so big that the child's attempts to learn on this basis may end in frustration. In the discussion following Gough's paper, James Jenkins (369) remarks that it might be necessary to increase both the cognitive load and the volume of input and possible matches to give the child a corpus that is big enough to work on as well as enough motivation to solve the problem. Gough on the other hand recommends the already well-known method of short messages and co-variation, letting the child read words like *cat*, *mat*, *pat*, etc. 'If a change in a cipher-text is also accompanied by a change in the corresponding plain-text, the solution is obvious' (350). He finds it surprising that this method has not been shown to be superior. Gough ends his section on decoding by saying that it is a mystery how the child solves the decoding problem.[1] He asks for experimental studies of reading acquisition, where we know what was presented to the child, when, in what manner and how often (p. 351). As I carried out such an experiment some years ago, and as the results of that experiment afford a number of facts relevant to the problems discussed above, I shall give a brief review of it here (see also Söderbergh 1971).

A case study of early reading acquisition

In 1965 I started to teach a girl, then 2;4, to read by a whole-word method. My starting-point was a book by Doman (1964) that had been translated into Swedish in 1965. As a linguist I was interested to know not only if such a small child could really learn to read, but rather how the child could acquire full reading ability, i.e. succeed in BREAKING THE CODE. The treatise describing the experiment gives a detailed account of the child's strategies.

The experiment started at the end of September 1965. During the first six weeks the child was presented with words denoting things and actions familiar to her. The words were written down with 7 cm high letters on cards, one word on each card. At the same time as a card was presented to the child, the word was pronounced and the corresponding thing was shown (if the word denoted an action this action was illustrated). When, after six weeks, the child had in this way accumulated a sight vocabulary of about 50 words, I wrote a book ADAPTED TO THE LANGUAGE OF THE GIRL and dealing with things of interest to her. The book contained about 80 new words. The words in the book were written down on cards and presented to the girl. When she had learned the words from the book, the cards were put on the floor to form the sentences in the book. As the sentences were adapted to her actual knowledge of the spoken language, she had no difficulty in reading them. At last she got the book to read, the words being written in letters about 2.5 cm high. The experiment had then been going on for three months. The girl read the book with good understanding – she even made comments on the contents. After the first home-made book, we went on to very short and simple picture books for children, with approximately one sentence on each page. The words were written down on cards and shown to the girl. When she knew the words in the first sentence of a book, the cards were put together to form that sentence, and so we went on until she had read all the sentences of the book. Then, at last, she got the book to read.

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[1] In Savin's discussion of the whole-word method (325) there is no suggestion that the child is capable of solving this problem. Savin seems to think that a child learning by the whole-word method must learn to recognize every single written word he is ever going to read: he mentions some 60,000 words as an estimate of the average college student's active vocabulary, and from this perspective he calls the whole-word method 'inefficient to the point of absurdity'.

Because the sentences and the books were very short, reading never became tedious. Only a few new words made it possible to read a new sentence – which the girl found much more interesting than to read separate words – and the sentences very soon made a new book. To get a new book to read was a great event to the girl, not least because as soon as she had read it, the book was entirely her own; it was placed on her own bookshelf and she was allowed to read it and play with it as she pleased. The result was that she took down her books very often, reading them over and over again to herself, thus repeating the visual shapes of the words until they must have become as familiar to her as the spoken counterparts.

Already at the end of the first month of the experiment the girl began to make comments on the written words, e.g. *mage* (stomach) *is like öga* (eye). These comments became more and more frequent, and I noted all of them. When they did not refer to the semantic content of the words, the comments referred to graphic similarities between the new word presented and earlier learned words. Through an analysis of these comments it was evident that the words presented were learned visually and STORED. As soon as a new word was introduced, this word was not only 'put into the bag', but it was analysed and compared with the visual images of the words learned before. By means of such comparisons structure was discovered. The discovery of the structure of the written words was made easier for the girl when during the months of January, February and March (months 4–6 in the experiment) I presented the letters of the alphabet to her. Each letter was written on a separate card, in both small letters and capitals, and the child was taught just the conventional names of the letters, without any attempt to giving the sound values.

In March, which was the sixth month of reading, a new stage was reached, as the girl then began to make her first attempts at reading the new cards presented to her before I told her what was written on them. I then changed the technique of showing cards, always starting by asking her what was written on a card before telling her. I noted her answers, and in that way it was possible for me to follow closely the process of breaking the code. Her reading of a new card could always be explained by referring to her reading vocabulary, i.e. all the cards read before this new card was presented. The method of putting all the words of the books on reading cards gave me a complete index to the child's reading vocabulary. This enabled me to find very easily PATTERNS for every attempted independent reading of a new word.

The readings were of two main kinds:

1. WHOLE-WORD READINGS, where a new word was mistaken for a (visually similar) earlier learnt word. In that way *såg* ('saw' vb.) was mistaken for *stå* ('stand'), *allihop* ('everybody') was assumed to be the previously learnt *Hoppelihopp* (interjection used in connection with jumping).

2. ANALYTICAL READINGS, made up of earlier learned reading material.

(*a*) *Adjunctions*. The new word *hattaffären* ('the hat shop') was read correctly, as it consisted of the earlier learnt words *hatt* ('hat') and *affären* ('the shop'). The new *pengarna* ('the money') was also read correctly, as it was made up of the earlier learnt *pengar* ('money') and *-na* (definite article used in the plural, met in earlier reading material in the following words: *tassarna*, *kattungarna*, *fjärilarna*, *fåglarna*, *grodorna*, *blommorna*).

(*b*) *Deletions*. The new word *ugglan* ('the owl') was read correctly on the basis of an earlier learnt *ugglans* ('the owl's'). The discrimination of *-s* was made possible by pairs occurring earlier such as *Anna–Annas*, *Astrid–Astrids*, *Mirran–Mirrans*.

(*c*) *Substitutions*. We have an instance of substitution when *köper* ('buys') is read correctly on the base of an earlier learnt *köpa* ('buy') and pairs of words like *frysa* ('freeze') – *fryser* ('freezes'), *krypa* ('crawl')–*kryper* ('crawls'), etc.

The analytical readings give us the cue to how the code is broken. The entities added, deleted and substituted in the analytical readings are, during March, all MORPHEMES: either WORDS (independent morphemes) or – more frequently – ENDINGS (dependent morphemes). Moreover, these morphemes are all SYLLABIC – with the only exception of the consonant /s/ corresponding to the letter (syngrapheme) *s*, which, however, is only deleted, i.e. not actually read out. This is altogether consistent with the observation made by Mattingly, Savin and others, that the syllable is the most easily available perceptual unit. Moreover, the child does not observe and read all kinds of syllables, but only syllables which are relevant to the semantic and syntactic structure, the morphemes: words, bases of words and inflectional endings.

As the experiment goes on, the analytical readings increase substantially.

There are also many wrong analytical readings. As examples may be mentioned *gröten* ('the porridge') which is read *grönen*, with the base wrongly supposed to be the earlier learned *grön* ('green'), and through adjunction of this *grön* and the ending *-en* (definite article), which is frequent in the reading material. The interesting thing about the analytical misreadings is that as a rule the dependent morphemes (= the inflectional endings) are correctly handled. If there is a mistake in the reading of an inflectional ending, this ending is always mistaken for another inflectional ending, e.g. *klappade* ('patted') is read as *klappande* ('patting'), *fortare* ('quicker') is read as *fortade* ('quicked'). This may be compared with the results of a reading experiment made by Gibson and Guinet in 1971 and referred to by Eleanor Gibson in her keynote address to the conference. In this experiment, subjects from third and fifth grades and college students were tested on stem words (consisting of words, pronounceable pseudo-words and unpronounceable pseudo-words) (*a*) with endings and (*b*) without endings. The INFLECTIONAL endings were read with fewer errors than the non-inflectional endings on pseudo-words of equivalent length. If an error was made on the inflectional ending, there was a tendency to substitute one of the other inflections (e.g. *-ing* for *-ed*). Gibson and Guinet carried out this experiment to clarify the influence of syntax and knowledge of syntax on reading. As there was an increased tendency for the above between third and fifth grade, Gibson draws the conclusion that 'inflectional endings do come to be processed as unitary word features, and this is done increasingly as reading skill develops' (16). From my experiment, however, it seems evident that the processing of inflectional endings as unitary word features is the very starting point of the breaking of the code when the child is presented to whole words as entities, and that the semantic-syntactic intuition even of children of 2;6 to 3;0 is big enough to make such a processing possible.

Returning to my experiment, the next stage in the breaking of the code is what I have called GRAPHEMATIC READINGS (in Söderbergh 1971), but what I now would prefer to call SYLLABIC NON-MORPHEMATIC READINGS and GRAPHEMATIC READINGS proper. At the same time as the analytical readings of morphemes increase, from April on, involving not only simple morphemes but strings of morphemes,[1] the child begins to handle NON-MORPHEMATIC GRAPHEMES in her analytical readings. An example is the reading *parken* ('the park'), made on the base of the earlier reading *marken* ('the ground') (As a matter of fact, the girl herself gave me the clue to this pattern. As I expressed my astonishment that she could read the new word *parken*, she frankly said, 'But I have had *marken* before'!) In this example *m* has been substituted for a *p*. Patterns for this substitution, however, are found in *mamma* (mummy) and *pappa* (daddy), where *m* and *p* respectively occur immediately before an *a*, exactly as in *marken* and *parken*. In fact almost all spontaneous readings of new words from April to October classed as graphematic readings have strong patterns in earlier reading material FOR EXACTLY THE GRAPHOPHONOTACTIC STRUCTURE OF THE SURROUNDINGS OF THE GRAPHEME THUS READ. In the graphematic readings either autographemes (vowels) or syngraphemes (consonants) may be involved. When a graphematic reading of a certain syngrapheme (consonant) occurs for the first time, this syngrapheme is almost always situated initially or finally in immediate combination with an autographeme. This means that the earliest spontaneous readings of non-morphemes are in fact SYLLABIC READINGS. Examples are the readings of *l* in *visslar* ('whistles'), where *l* precedes *-ar* and where there are patterns in the reading material such as *bollar* ('balls'), *cyklar* ('cycles'), *dalar* ('falls'), etc. Not until a syngrapheme has occurred in many syllabic readings does it turn up in readings where the girl has not had the extra help of an adjacent autographeme. An example is the reading in October of *förarhytten* ('the cabin') as /fø:-rar-h-ten/,[1] where the *y* is overlooked, and which shows a sure knowledge of the correspondence *h*-/h/. These 'pure' graphematic readings, without the support of a syllable, increase in October (in the thirteenth month of the reading experiment).

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[1] In Swedish, strings of inflectional endings are added to the base words, e.g. *fjäril-ar-na-s* (of the butterflies), where *-ar* marks plural, *-na* plural and definite form, *-s* genitive.

Between April and the end of October the graphematic readings become further complicated in the sense that the number of other elements involved in the reading process increases. In April, May and June no more than one or two elements besides the syngrapheme are involved, e.g. ***brum*** /b-rum/ (b+'room'), ***måltid*** /mɔː-tiːd/ (mɔ+'time'). In October, 53% of the readings of new words contain from three to seven other elements. Examples of graphematic readings of new reading cards presented in October, where a great many elements have been added, are the following: *diskbänkar* ('sinks') read as /diː-s-k-b-ɛː-n-k-ar/ and *plötsligt* ('suddenly') read as /pl-øː-t-s-l-i-g-t/. The last reading shows a tendency which becomes very marked at the end of October: when tackling a new word, the reader overlooks a more simple way of reading – through analysis into well-known morphemes – and makes a more complicated graphematic reading. Thus *ställningar* ('scaffoldings') containing the morphemes *ställ*+*ning*+*ar* is not read /stɛl-niŋ-ar/, with a substitution of the well-known *-ningar* for *-er* in earlier learned *ställer*, but is read /stɛː-l-niː-n-gar/, with *l* and *n* as separate grapho-phonematic entities. This indicates a growing certainty as to the grapho-phonematic correspondences. It is to be observed that by the middle of October all autographemes and syngraphemes in the reading material, except for *w*, *x* and *z* (graphemes which are comparatively seldom used in normal Swedish orthography), were used in correct graphematic readings. The final piece of evidence, however, that the code had been broken and the child had attained full reading ability was provided on December 31st. Some weeks earlier I had told the girl a story in which the Nordic goddess Freja plays an important part. It may be noted that she had never seen the name *Freja* printed. On December 31st the girl asked me: 'Who do you think I am today? It begins with an *f*...(spelling in a loud voice) *f*, *r*, *e*...(almost silently, to herself) *fre*, *frej*...(spelling again in a loud voice) *j*, *a*.' This transforming of a word from the spoken language to the written, from phonemes to graphemes, which is the reversed process of graphematic reading, provides convincing evidence that the code has been broken by the child.

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[1] Hyphens mark sectionings made by the girl. When reading a new card, she generally made a first reading in sections and a second (sometimes a third) where she synthesised (i.e. 'blended') the elements: see Söderbergh 1971: 102.

The girl has thus, during 14 months of reading, gradually become aware of the phonemes and of the grapho-phonematic correspondences. First she has been able to discriminate, and actively use in new readings, syllables that are tied to certain meanings, i.e. morphemes. These morphemes are words, base words (root morphemes) and inflectional endings. Then she becomes able to discriminate and handle syllables that are not morphematic, and – finally – in these syllables she discriminates graphemes-phonemes. During this 14-month period, 22 printed books were read containing about 2,000 different words. The child always read the books aloud, and she made remarkable technical progress in reading connected text through the whole experimental period. Many useful observations were made on the child's intonation, her relating of the reading material to her own earlier experiences, her appreciation of the books read, her application of the contents of the books in her plays, her practical use of the experiences encountered in literature, and so on. All of this suggests that parallel to breaking the code she had also developed a skill in reading with understanding; she had acquired real reading ability. 'The problem of avoiding noise from the decoding' – also called the 'speed problem' – was reduced to almost nothing. Through the whole-word method as it was used in this experiment, the child's reading of books was totally based on a well-known sight vocabulary, which prevented 'noise from the decoding' to interfere with the synthesis of words into sentences and which made the reading quick enough to avoid decay in PM. When, after 14 months of reading, the child had broken the code totally, we did not write any more reading cards, as her sight vocabulary was then big enough to ensure that the new words she met in a new book would be so relatively infrequent that the decoding of them could not cause any serious disturbance.

This experiment, then, might help to solve two of the main problems discussed during the conference: (1) how to make the child aware of the phoneme and eventually to break the code; (2) how to help the child arrive at fluent, connected reading with full understanding of the material read, without intervening noise from the decoding process. This is, of course, only a case study. But there is good reason to believe that the observations made here are universally valid. Personally, however, I am of the opinion that this is a method that can be used with success only at an early age, when the child is linguistically very active – i.e. during the period of acquisition of the first spoken language, from approximately 1;6, when he has reached the two-word stage in his spoken language, to 3;6, when he has acquired his elementary grammar.[1] As it is possible to make a child naturally bilingual – or even polylingual – between the ages of 3 and 5, just by exposing him to spoken language in a natural context, so it is possible to give him a written language (Andersson 1974). This might be done along the lines shown here – where the written language should be adapted directly to the child's oral language development (Söderbergh 1973) – or by relating the written language directly to things and reality. This last way seems to be a fruitful method of giving deaf children a language (an experiment in teaching 2- to 5-year-old deaf children to read commenced in Stockholm in the spring of 1974). This method should however preferably be combined with finger-spelling, both to compensate for the lack of an oral language, and to give the child a means of two-way communication in conversation with other people.

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[1] See Söderbergh 1972. Cf. also a remark of Carroll's made during the conference, 'that the transfer from spoken to written language may be easier when the experience of acquiring the spoken language is still recent' (21).

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